

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 8288 (1976): Bakeable Flanges [MED 17: Chemical Engineering Plants and Related Equipment]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



IS : 8288 - 1976

*Indian Standard*  
SPECIFICATION FOR  
BAKEABLE FLANGES

UDC 621.643.412.8 : 621.52



© Copyright 1977

INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

Price Rs 5.<sup>00</sup>

April 1977

# Indian Standard

## SPECIFICATION FOR BAKEABLE FLANGES

Chemical Engineering Sectional Committee, EDC 57

### Chairman

DR O. P. KHARBANDA

### Members

SHRI P. M. MEHTA ( *Alternate to*  
Dr O. P. Kharbanda )

DR K. AGHORAMURTHY

SHRI M. V. NAIK ( *Alternate* )

SHRI A. K. BASU

DR A. S. BHADURI ( *Alternate* )

SHRI S. N. BHATTACHARYA

SHRI A. N. TASKAR ( *Alternate* )

DR B. K. BHATTACHARJEE

DR T. GUHA ( *Alternate* )

SHRI M. R. BHATTACHARJEE

SHRI B. BANERJEE ( *Alternate* )

SHRI A. K. BOSE

SHRI A. B. MALLICK ( *Alternate* )

DR K. S. CHARI

SHRI R. SADAGOPA CHARI

SHRI S. L. ARANHA ( *Alternate* )

SHRI P. T. CHERIAN

SHRI B. R. CHOUDHURY

DR R. KRISHNAMURTY ( *Alternate* )

SHRI R. L. DALAL

SHRI R. JAISHANKAR ( *Alternate* )

DR L. K. DORAISWAMY

SHRI M. V. KUNTE ( *Alternate* )

DR H. E. EDULJEE

SHRI J. N. GOSWAMY

SHRI H. T. PAYRI ( *Alternate* )

SHRI J. P. KAPUR

SHRI R. KALIDAS ( *Alternate* )

### Representing

Larsen & Toubro Ltd, Bombay

Indian Petrochemicals Corporation Ltd, P. O.  
Jawaharnagar

Indian Institute of Chemical Engineers, Calcutta

Tata Chemicals Ltd, Mithapur

I. C. I. ( India ) Private Ltd, Calcutta

The A. P. V. Engineering Co Private Ltd, Calcutta

Directorate General of Technical Development,  
New Delhi

Fertilizer Association of India, New Delhi  
Bharat Refineries Ltd, Bombay

Oil and Natural Gas Commission, Dehra Dun  
Engineer's India Ltd, New Delhi

Dalal Consultants & Engineers Pvt Ltd, Bombay

Council of Scientific and Industrial Research,  
New Delhi

Indian Chemical Manufacturers Association,  
Calcutta

Lloyd's Register of Shipping, Bombay

Indian Chemical Manufacturers Association,  
Calcutta

( Continued on page 2 )

© Copyright 1977

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
DR M. G. KRISHNA	Indian Institute of Petroleum ( CSIR ), Dehra Dun
SHRI H. K. MULCHANDANI ( <i>Alternate</i> )	
SHRI K. MANIVANAN	Directorate of Industries, Government of Haryana, Chandigarh
SHRI B. B. MATHUR	Delhi Cloth & General Mills Co Ltd, Delhi
SHRI I. B. LAL ( <i>Alternate</i> )	
SHRI A. DUTTA MAZUMDAR	Fertilizer Corporation of India Ltd, New Delhi
SHRI N. K. SETUBAM ( <i>Alternate</i> )	
SHRI R. C. MISRA	Bharat Heavy Electricals Ltd, Bhopal
SHRI K. MUKHERJEE	Walchandnagar Industries Ltd, Bombay
SHRI R. C. RATHI ( <i>Alternate</i> )	
SHRI S. K. NAYAK	Indian Oil Corporation Ltd ( Refineries Division ), New Delhi
SHRI K. C. JAIN ( <i>Alternate</i> )	
SHRI P. K. PAI	Hindustan Petroleum Corporation Ltd, Bombay
SHRI H. B. DESAI ( <i>Alternate</i> )	
SHRI R. V. RAGHAVAN	Vijay Tanks & Vessels Pvt Ltd, Bombay
DR N. RAJASEKHARAN	Pennwalt India Ltd, Bombay
SHRI J. S. KAUL ( <i>Alternate</i> )	
SHRI A. B. RAI	DESMET ( India ) Pvt Ltd, Bombay
SHRI M. L. KACHRU ( <i>Alternate</i> )	
SHRI A. P. RAO	Bharat Heavy Plate & Vessels Ltd, New Delhi
SHRI M. VENKATARATNAM ( <i>Alternate</i> )	
SHRI V. K. RAO	Ion Exchange ( India ) Ltd, Bombay
SHRI A. K. CHATHURVEDI ( <i>Alternate</i> )	
SHRI V. M. RAO	K. C. P. Ltd, Madras
SHRI K. SAMBASIVA RAO ( <i>Alternate</i> )	
SHRI D. S. SASTRY	Hindustan Organic Chemicals Ltd, Bombay
DR J. K. N. SHARMA	National Physical Laboratory ( CSIR ), New Delhi
SHRI D. D. SHARMA	The Indian Sugar & General Engineering Corporation, Yamunanagar
SHRI N. K. GUPTA ( <i>Alternate</i> )	
SHRI S. SUBBIAH	Directorate General of Supplies and Disposals, New Delhi
DR V. C. THAKAR	Associated Cement Companies Ltd, Bombay
SHRI A. K. MISSE ( <i>Alternate</i> )	
DR Y. VENKATESHAM	National Research Development Corporation of India, New Delhi
DR D. S. VISWANATH	Indian Institute of Science, Bangalore
DR P. K. DESHPANDE ( <i>Alternate</i> )	
SHRI S. N. WAZIR	Metallurgical and Engineering Consultants ( India ) Ltd, Ranchi
SHRI N. M. MANCHANDA ( <i>Alternate</i> )	
SHRI S. CHANDRASEKHARAN, Deputy Director ( Mech Engg )	Director General, ISI ( <i>Ex-officio Member</i> )

*Secretary*

SHRI GURCHARAN SINGH  
Assistant Director ( Mech Engg ), ISI

( Continued on page 10 )

# *Indian Standard*

## SPECIFICATION FOR BAKEABLE FLANGES

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 29 November 1976, after the draft finalized by the Chemical Engineering Sectional Committee had been approved by the Mechanical Engineering Division Council.

**0.2** This standard is based on draft International Standard ISO/DIS 3669 'Vacuum technology — Bakeable flanges — Dimensions' issued by the International Organization for Standardization.

**0.3** International system (SI) of units have been used in the standard. The relationship of these units to other units are given below for guidance:

$$\begin{aligned} 1 \text{ pascal (Pa)} &= 1 \text{ newton/square metre (N/m}^2\text{)} \\ &= 0.102 \text{ kgf/m}^2 \\ 1 \text{ torr} &= 1 \text{ mmHg} = 133.322 \text{ Pa} \end{aligned}$$

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

### 1. SCOPE

**1.1** This standard specifies the dimensions of fixed or rotatable bolted bakeable flanges used in vacuum systems where pressure under steady conditions is less than  $10^{-5}$  Pa. These flanges may also be used in those parts connected with the vacuum system where the vacuum is not so high.

**1.2** The standard covers two series of flange dimensions, the preferred series and secondary series. The preferred series of dimensions ensure compatibility with the flanges conforming to IS : 6076-1971†. The secondary series is corresponding to flanges in common use.

\*Rules for rounding off numerical values (*revised*).

†Dimensions for vacuum flanges.

## 2. DESIGNATION

2.1 A flange of nominal bore 10 shall be designated as:  
Flange 10 IS : 8288

## 3. DIMENSIONS

### 3.1 General

3.1.1 The dimensions shall be as given in Tables 1 and 2. They do not include allowances for machining.

3.1.2 The material shall be compatible with the requirements for the flanges (baking, sealing capacity, profile, thickness of flange and type of seal gasket used).

3.1.3 To ensure interchangeability of vacuum components, the flanges shall be aligned so that the bolt holes are equispaced about and off the symmetrical plane of the component. (This does not apply to flanges with six bolt holes in the secondary range.)

### 3.2 Nominal Bore

3.2.1 The nominal bores indicated in the tables provide a series of values intended to identify the flanges. They correspond to the nominal bores of pipes in general use.

3.2.2 Nominal bores 63 and 160 in Tables 1 and 2 correspond to practical diameter 70 mm (or 65 mm) and 150 mm respectively.

### 3.3 Mating Face

3.3.1 *General* — The mating face (which is flat in the case of the preferred series and in the form of a profile in the case of the secondary series) is in the form of a ring, the surface finish or the profile of which makes possible the effective sealing of the joint.

3.3.2 *Limits* — For the preferred range, the minimum mating face area is defined by an outside diameter  $E$  and by an inside diameter  $F$ .

For the secondary range, the mating face area is defined by diameters  $F$  and  $T$ . In this case, the profile of the mating face is not specified and is left to agreement between the manufacturer and the user but in any case it shall comply with the requirement mentioned in 3.3.1.

3.4 *Number of Bolt Holes,  $n$*  — The linear sealing loads tabulated in Appendix A for a given bolt stress are derived from the values of  $n$ .



**3.5 Specific Requirements** — It is recommended that the flanges be provided with a device ( at the option of the manufacturer ) to facilitate their separation for any dismantling of the coupling.

#### 4. MARKING

**4.1** Each flange shall be marked with the name of the manufacturer or trade-mark, nominal bore, material of construction and year of manufacture.

**4.1.1** The flange may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## APPENDIX A

( *Clause 3.4* )

### LINEAR SEALING LOADS

#### A-1. LINEAR SEALING LOADS FOR PREFERRED SERIES OF FLANGES

**A-1.1** The linear sealing loads are given below, which have been calculated for each flange under the following conditions:

- a) For a bolt of cross-sectional area  $s$  ( in square millimetres ), the linear sealing load ( expressed in newtons per millimetre ) is  $P_{500}/B$ . This load is exerted at the bolt circle (  $\phi B$  ) by the uniform tightening of  $n$  bolts to a stress of 500 MPa.

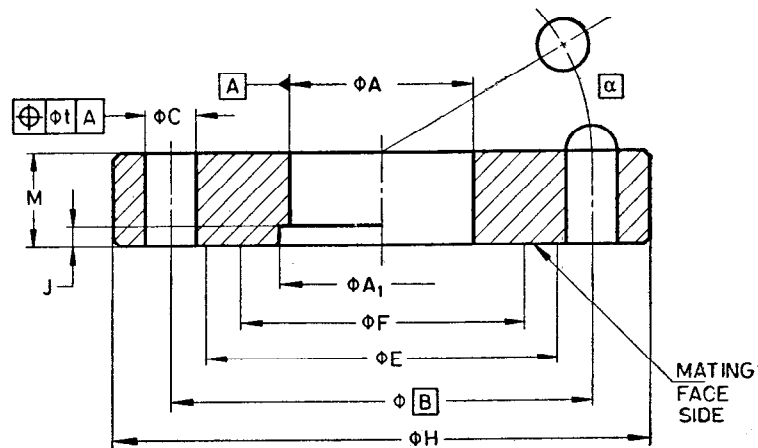
Hence

$$P_{500}/B = \frac{500 \, n \cdot s}{\pi B}$$

TABLE 1 PREFERRED RANGE OF FLANGE DIMENSIONS

(Clauses 3.1.1 and 3.2.2)

All dimensions in millimetres.



NOMINAL BORE No.	$A^*$	$H$ h13	$M^†$ js16	$B$	BOLTS		EQUISPACED HOLES $C$		$A_1$ H11	$J^†$ Min	$E$	$F$
					Number	Diameter	Diameter H 13	$t$				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
10	10	55	12	40	8	6	6.6	0.6	12.2	2.5	31	23
16	16	60	12	45	8	6	6.6	0.6	17.2	2.5	36	28
25	24	70	12	55	12	6	6.6	0.6	26.2	2.5	46	37

40	39.2	100	16	80	12	8	9	1	41.2	2.5	69	58
63	70	130	16	110	16	8	9	1	70	2.5	99	87
100	102	165	20	145	24	8	9	1	102	2.5	134	120
160	153	225	20	200	24	10	11	1	153	4.5	186	170
250	161	335	24	310	36	10	11	2	261	4.5	296	280
400	400	510	24	480	48	12	14	2	400	4.5	462	446
630	651	750	30	720	90	12	14	2	651	4.5	702	686
1 000	1 000	1 120	30	1 090	96	12	14	2	1 000	4.5	1 072	1 056

\*Given for guidance only and depends on the tube and the method of welding.

†Given for guidance only and corresponds to commonly used austenitic stainless steel flanges.

‡Minimum height over which dimension  $A_1$  shall be respected.



b) Flanges are expected not to have been deformed during tightening.

<i>Nominal bore</i>	$P_{500}/B$ N/mm
10	610
16	550
25	670
40	850
63	810
100	940
160	1 070
250	1 000
400	1 300
630	1 430
1 000	1 100

**A-1.2** In practice, it is necessary to calculate the linear sealing load on the basis of the mean diameter of the seal.

## **A-2. LINEAR SEALING LOADS FOR SECONDARY SERIES OF FLANGES**

**A-2.1** The linear sealing loads are, given below. The values given correspond to the linear sealing loads (expressed in newtons per millimetre) exerted at the level of the mating face and are based on a bolt stress of 200 MPa.

<i>Nominal bore</i>	<i>Linear Sealing Load</i> N/mm
16	134
40	200
63	240
100	320
160	280
200	256

( Continued from page 2 )

Panel for Standardization of Vacuum Equipment, EDC 57 : P2

<i>Convener</i>	<i>Representing</i>
DR J. K. N. SHARMA	National Physical Laboratory ( CSIR ), New Delhi
<i>Members</i>	
DR S. S. S. AGARWALA	Central Electronics Engineering Research Institute ( CSIR ), Pilani
SHRI C. AMBASANKARAN	Bhabha Atomic Research Centre, Bombay
SHRI P. VIJENDRAN ( Alternate )	
SHRI BIJAN KUMAR DUTTA	Basic & Synthetic Chemicals Pvt Ltd, Calcutta
SHRI BIMALENDRANATH CHAKRABORTY ( Alternate )	
SHRI S. V. NARASAIH	Hind High Vacuum Co ( P ) Ltd, Bangalore
SHRI V. K. V. RAJU ( Alternate )	
SHRI VED PRAKASH	Vacuum Instruments Company, New Delhi
SHRI R. RAMADRAHMA	Toshniwal Bros Pvt Ltd, Madras
SHRI D. J. RAO ( Alternate )	
SHRI B. S. RAMAPRASAD	Indian Institute of Science, Bangalore
DR D. S. VISWANATH ( Alternate )	
SHRI S. C. RANADIVE	J. B. Sawant Engineering Pvt Ltd, Bombay
DR B. K. SARKAR	Vikram Sarabhai Space Centre, Trivandrum
SHRI R. V. PERUMAL ( Alternate )	
SHRI G. V. SATHE	Vacuum Plant & Instruments Mfg Co Pvt Ltd, Mundhawa
SHRI R. R. KARANDIKAR ( Alternate )	
SHRI V. P. SUNDERSINGH	Indian Institute of Technology, Bombay
DR S. R. JAWALEKAR ( Alternate )	

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Conversion
Force	newton	N	1 N = 1 kg.1 m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

## INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephone : 27 01 31 ( 20 lines )

Telegrams : Manaksanstha

### Regional Offices:

	Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007 37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072 23-08 02
Southern : C. I. T. Campus, Adyar	MADRAS 600020 41 24 42

### Branch Offices:

' Pushpak ', Nurmohamad Sheikh Marg, Khanpur	AHMADABAD 380001 2 03 91
' F ' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002 2 76 49
Ahimsa Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017 2 83 20
5-8-56/57 L. N. Gupta Marg	HYDERABAD 500001 4 57 11
117/418 B Sarvodaya Nagar	KANPUR 208005 82 72
B. C. I. Bldg ( 3rd Floor ), Gandhi Maidan East	PATNA 800004 5 36 55
Hantex Bldg ( 2nd Floor ), Rly Station Road	TRIVANDRUM 695001 32 27